09/522808

CPC

JUN 27 2005

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313 on June 23, 2005.

James S. Parker, Patent Attorney

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322 AND UNDER 37 CFR 1.323
Docket No. MRI-100
Patent No. 6,836,118

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King
Issued	:	December 28, 2004
Patent No.	:	6,836,118
For	:	Method and Apparatus for NMR Imaging

Certificate
JUN 30 2005
of Correction

Mail Stop CERTIFICATE OF CORRECTIONS BRANCH
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322 (OFFICE MISTAKE)

Sir:

A Certificate of Correction for the above-identified patent has been prepared and is attached hereto.

In the left-hand column below is the column and line number where errors occurred in the patent. In the right-hand column is the page and line number in the application where the correct information appears.

JUL 06 2005

Patent Reads:	Application Reads:
Column 6, Line 29: "FIGS. **12**, **10**A and **10**A'"	Pg. 2 of Amendment dated 6/6/02 reads: --Figure 12, **10A** and--
Column 6, Line 33: "of FIGS. **9**A"	Pg. 2 of Amendment dated 6/6/02 reads: --of Figure 9A;--
Column 6, Line 35: "**15**B of FIGS. **9**A"	Pg. 2 of Amendment dated 6/6/02 reads: --**15B** of Figure 9A--
Column 7, Line 57: "Referring to FIGS. **10**"	Pg. 4 of Amendment dated 6/6/02 reads: --Referring to Figure 10--
Column 8, Line 11: "FIGS. **11**,"	Pg. 11, Line 27 of the orig. specification reads: --Figure 11--
Claim 11, Column 11, Line 32: "the fit magnetic"	Claim 12, Line 2 reads: --the first magnetic field--
Claim 15, Column 11, Line 54: "the frost and"	Claim 15, Line 3 reads: --the first and--
Claim 23, Column 12, Line 52: "has odds symmetry"	Claim 37, Line 6 reads: --has odd symmetry--
Claim 27, Column 13, Line 9: "in the region"	Claim 41, Line 4 reads: --in a region--
Claim 30, Column 13, Line 40: "associates with"	Claim 40, Line 2 reads: --associated with--
Claim 31, Column 13, Line 43: "flooring steps:"	Claim 45, Line 2 of Amendment dated 5/24/04 reads: --following steps:--
Claim 45, Column 15, Line 9: "a second cell,"	Claim 75, Line 10 reads: --a second channel--
Claim 56, Column 16, Line 15: "having current"	Claim 71, Line 8 reads: --having currents--

JUL 0 6 2005

A true and correct copy of relevant pages of the Amendment Under 37 CFR §1.111 filed June 6, 2002, relevant pages of Amendment Under 37 CFR §1.111 filed May 24, 2004, and page 11 of the original specification as filed March 10, 2000 accompany this Certificate of Correction which support Applicants' assertion of the error on the part of the Patent Office.

The Commissioner is also authorized to charge any additional fees as required under 37 CFR 1.20(a) to Deposit Account No. 19-0065. Two copies of this letter are enclosed for Deposit Account authorization.

Approval of the Certificate of Correction is respectfully requested.

Respectfully submitted,

James S. Parker.
Patent Attorney
Registration No. 40,119
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: P.O. Box 142950
Gainesville, FL 32614-2950

JSP/ lkw
Attachments:

1) Certificate of Correction
2) Copy of relevant pages of the Amendment Under 37 CFR §1.111 filed June 6, 2002
3) Copy of relevant pages of the Amendment Under 37 CFR §1.111 filed May 24, 2004
4) Copy of page 11 of the original specification as filed, March 10, 2000

JUL 06 2005

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,836,118

DATED : December 28, 2004

INVENTOR : David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6,
Line 29, "FIGS. **12**, **10**A and **10**A'" should read -- Figure 12, **10A** and--.

Column 6,
Line 33, "of FIGS. **9**A" should read --of Figure 9A;--.

Column 6,
Line 35, "**15**B of FIGS. **9**A" should read --**15B** of Figure 9A--.

Column 7,
Line 57, "Referring to FIGS. **10**" should read --Referring to Figure 10--.

Column 8,
Line 11, "FIGS. **11**," should read --Figure 11--.

Claim 11, Column 11,
Line 32, "the fit magnetic" should read --the first magnetic field--.

Claim 15, Column 11,
Line 54, "the frost and" should read --the first and--.

Claim 23, Column 12,
Line 52, "has odds symmetry" should read --has odd symmetry--.

MAILING ADDRESS OF SENDER: Saliwanchik, Lloyd & Saliwanchik
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Gainesville, FL 32614-2950

PATENT NO. 6,836,118

No. of additional copies ⇨ 1

JUL 0 6 2005

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,836,118 Page 2 of 2

DATED : December 28, 2004

INVENTOR : David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King

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Claim 27, Column 13,
Line 9, "in the region" should read --in a region--.

Claim 30, Column 13,
Line 40, "associates with" should read --associated with--.

Claim 31, Column 13,
Line 43, "flooring steps:" should read --following steps:--.

Claim 45, Column 15,
Line 9, "a second cell," should read --a second channel--.

Claim 56, Column 16,
Line 15, "having current" should read --having currents--.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,836,118 Page 1 of 2

DATED : December 28, 2004

INVENTOR : David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6,
Line 29, "FIGS. **12**, **10**A and **10**A'" should read -- Figure 12, **10A** and--.

Column 6,
Line 33, "of FIGS. **9**A" should read --of Figure 9A;--.

Column 6,
Line 35, "**15**B of FIGS. **9**A" should read --**15B** of Figure 9A--.

Column 7,
Line 57, "Referring to FIGS. **10**" should read --Referring to Figure 10--.

Column 8,
Line 11, "FIGS. **11**," should read --Figure 11--.

Claim 11, Column 11,
Line 32, "the fit magnetic" should read --the first magnetic field--.

Claim 15, Column 11,
Line 54, "the frost and" should read --the first and--.

Claim 23, Column 12,
Line 52, "has odds symmetry" should read --has odd symmetry--.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,836,118

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It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 27, Column 13,
Line 9, "in the region" should read --in a region--.

Claim 30, Column 13,
Line 40, "associates with" should read --associated with--.

Claim 31, Column 13,
Line 43, "flooring steps:" should read --following steps:--.

Claim 45, Column 15,
Line 9, "a second cell," should read --a second channel--.

Claim 56, Column 16,
Line 15, "having current" should read --having currents--.

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P.O. Box 142950
Gainesville, FL 32614-2950

PATENT NO. 6,836,118

No. of additional copies
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JUL 0 6 2005

JUN 27 2005

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on June 6, 2002.

James S. Parker, Patent Attorney

AMENDMENT UNDER 37 CFR §1.111
EXAMINING GROUP 2862
Patent Application
Docket No. MRI-100
Serial No. 09/522,808

COPY COPY

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	Tiffany A. Fetzner
Art Unit	:	2862
Applicant(s)	:	David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King
Serial No.	:	09/522,808
Filed	:	March 10, 2000
For	:	Method and Apparatus for NMR Imaging

Assistant Commissioner for Patents
Washington, D.C. 20231

AMENDMENT UNDER 37 CFR §1.111

Sir:

A Petition and Fee for a three-month extension of time through and including June 6, 2002 accompanies this response.

This is in response to the Office Action mailed December 6, 2001. It is respectfully requested that the above-identified application be amended as follows:

In the specification:

Please substitute the following paragraphs:

Page 8, lines 21-27 (amended):

Figure 5 shows an embodiment which incorporates top/bottom loops. In this embodiment

coil **31** and coil **32** form a top coil pair and coil **33** and coil **34** form a bottom coil pair. Preferably, the coil pairs overlap such that mutual inductance between coil **32** and coil **33** and between coil **31** and coil **34** is low. Most preferably, the amount of overlap can be selected so as to achieve approximately zero mutual inductance. Additional coil pairs can be added and/or the coil pair(s) can be rotated with respect to the central axis of the cylinder formed by loops **28**, **29**, and **30**.

Page 8, lines 28-29 and page 9, lines 1-5 (amended):

Figure 6 shows an embodiment of the subject invention incorporating side by side loops. Loops **37** and **40** form one loop pair and loops **38** and **39** form another. Preferably the amount of overlap of side by side loop pairs is chosen so that the mutual inductance of the loops is low, and, more preferably, the amount of overlap is chosen so that the mutual inductance is approximately zero. Additional loops can be added to one or more side by side pairs and/or additional side by side pairs can be added. Again, the side by side pairs can be rotated with respect to the central axis of the cylinder formed by loops **34**, **35**, and **36**.

Page 9, lines 17-24 (amended):

With respect to the embodiments shown in Figure 7 and Figure 9A, Figure 12 illustrates a specific embodiment of a capacitive network which can be used to minimize or cancel mutual inductance between the single solenoid and the crossed ellipse. Referring to Figure 12, **10A** and **10A'** represent the contacts for ellipse **10B** and are analogous to contacts **14A** and **14A'** for ellipse 14B of Figure 9A; **12A** and **12A'** represent the contacts for loop **12B** and are analogous to contacts **17A** and **17A'** for loop **17B** of Figure 9A; and **11A** and **11A'** represent the contacts for ellipse **11B** and are analogous to contacts **15A** and **15A'** for ellipse **15B** of Figure 9A. C1, C2, C3, and C4 are four capacitive elements of the capacitive network shown in Figure 12.

Page 9, lines 25-29, Page 10, lines 1-23, and Page 11, lines 1-9 (amended):

In a specific embodiment, the crossed ellipse/opposite rotating configuration shown in Figure

homogeneity down the axis of the cylinder.

In another embodiment of the subject invention, as shown in Figure 9B, coil pair **16B** and **18B** can be modified so as to produce an Alderman-Grant (Alderman, D.W. and Grant, D.M., *Jo. Magnetic Resonance* 36:447 [1979]) type of coil, such that coil **17B** is isolated from the Alderman-Grant coil due to the fields of the Alderman-Grant being perpendicular to the fields of coil **17B**. Such an Alderman-Grant coil can be achieved by adding a pair of conductors **30** and **31** to connect coils **16B** and **18B** such that conductors **30** and **31** carry the same magnitude current in opposite directions. The currents flowing in conductors **30** and **31** are split when the currents enter a coil, with one-half the magnitude of the current flowing in each half of the coil. For example, current flowing from conductor **30** flows one-half in each half of coil **18B** to conductor **31**, and current flowing from conductor **31** flows one-half in each half of coil **16B** to conductor **30**. **14A**, **15A**, and **17A** show the contacts for the various coils, and **30A** shows the contacts for the Alderman-Grant coil. In this embodiment, coils **17B** and the Alderman-Grant coil are isolated due to their perpendicular fields and coils **14B** and **15B** are isolated from one another by, for example, having their axes perpendicular to each other. Coil **17B** shares inductance and sample resistance with coils **14B** and **15B**, and the Alderman-Grant coil shares inductance and resistance with coil **14B** and **15B**.

<u>Page 11, lines 15-23</u> (amended):

Figures 10 and 11 illustrate switching networks which can be utilized with respect to the three solenoid embodiment, for implementing a method to allow the opposite rotation of the loop currents in either a series or parallel fashion. Figure 10 shows a switching network for allowing the outer two coils to have currents which either rotate in the same direction or in opposite directions. Referring to Figure 10, **1A'**, **2A'**, and **3A'** connect to the top contacts of loops **1B**, **2B**, and **3B** of Figure 1, while **1A**, **2A**, and **3A** connect to the bottom contacts. By closing switches **50** and **53**, loops **1B** and **3B** can be driven in the same rotation direction. By closing switches **51** and **52** and opening switches **50** and **53**, loops **1B** and **3B** can be driven in opposite rotation direction. Analogously, **1A'** , **2A'**, and **3A'** of Figure 11 can connect to the top contacts of loops **4B**, **5B**, and

I hereby certify that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office on the date shown below:

May 24, 2004

James S. Parker, Patent Attorney

AMENDMENT UNDER 37 C.F.R. § 1.111
Examining Group 2859
Patent Application
Docket No. MRI-100
Serial No. 09/522,808

COPY

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	Tiffany A. Fetzner
Art Unit	:	2859
Applicant	:	David A. Molyneaux, G. Randy Duensing, S. Uli Gotshal, Thomas E. Schubert, Alan Holland, Scott B. King
Serial No.	:	09/522,808
Conf. No.	:	5722
Filed	:	March 10, 2000
For	:	Method and Apparatus for NMR Imaging

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 CFR §1.111

Sir:

A Petition and Fee for a three-month Extension of Time through and including May 24, 2004, accompanies this Amendment.

In response to the Office Action dated November 24, 2003, please amend the above-identified application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 13 of this paper.

6. (original) The configuration according to claim 1, wherein each of said pair of coils and said single coil lie in planes parallel to each other, and wherein said essentially zero-flux contour is an essentially zero-flux plane.

7. (original) The configuration according to claim 6, wherein the pair of coils and the single coil are co-axial.

8. (original) The configuration according to claim 2,

wherein the single coil is a first channel and the pair of coils is a second channel such that coupling between the first channel and second channel is low.

9. (original) The configuration according to claim 8, wherein coupling between the first channel and second channel is approximately zero.

10. (original) The configuration according to claim 1, wherein the zero-flux contour is located between the pair of coils.

11. (original) The configuration according to claim 1, wherein the zero-flux contour is located outside the pair of coils.

12. (original) The configuration according to claim 10, wherein a second zero-flux contour with respect to the first magnetic field is located outside the pair of coils, further comprising a second single coil for generating a third magnetic field in the region of interest, wherein the second single coil is positioned at the second zero-flux contour with respect to the first magnetic field.

13. (original) The configuration according to claim 10,

wherein the single coil is positioned approximately equidistance from each of the pair of coils.

14. (original) The configuration according to claim 10, wherein the single coil is positioned closer to one of the coils of the pair of coils than to the other.

15. (original) The configuration according to claim 1, further comprising:

at least one Helmholtz coil pair associated with a third magnetic field essentially orthogonal to the first and second magnetic fields in the region of interest.

16. (original) The configuration according to claim 15, further comprising a means for utilizing said at least one Helmholtz coil pair for generating the third magnetic field.

17. (original) The configuration according to claim 15, wherein said Helmholtz coil pair is of a configuration selected from the group consisting of: large loops, top/bottom loops, side by side loops, and a combination thereof.

Claims 18-24 were canceled

25. (original) The configuration according to claim 1,

wherein said pairs of coils are connected together by a pair of electrical conductors to form an Alderman-Grant coil pair.

26. (original) The configuration according to claim 1, further comprising:

a switching means for allowing the pair of coils and the single coil to operate in and switch between two or more of the modes in the group consisting of:

(i) the coils of the pair of coils and the single coil having currents rotating in the same direction;

(ii) the coils of the pair of coils having currents rotating in the same direction, with the single coil operating independently;

(iii) the coils of the pair of coils having currents rotating in opposite directions, with the single coil operating independently; and

(iv) the coils of the pair of coils having currents rotating in the same direction and the single coil having a current rotating in an opposite direction with respect to the currents of the pair of coils.

Claims 27-35 were canceled.

36. (original) The configuration according to claim 1, further comprising:

at least one additional pair of coils, wherein said pair of coils in an opposite orientation has odd symmetry with respect to a plane,

wherein each of said at least one additional pair of coils is associated with a corresponding at least one additional magnetic field,

wherein each of said at least one additional pair of coils has even symmetry with respect to the plane and is associated with one of said at least one additional magnetic field such that said single coil is a first channel, said pair of coils in an opposite orientation is a second channel, and each of said at least one additional pair of coils is an additional channel which is orthogonal to the first channel, second channel, and each of the other additional channels.

37. (original) The configuration according to claim 1, further comprising:

at least one additional pair of coils, wherein said pair of coils in an opposite orientation has odd symmetry with respect to a plane,

wherein each of said at least one additional pair of coils is associated with a corresponding at least one additional magnetic field,

wherein each of said at least one additional pair of coils has odd symmetry with respect to the plane and is associated with one of said at least one additional magnetic field such that said single coil is a first channel, said pair of coils in an opposite orientation is a second channel, and each of said at least one additional pair of coils is an additional channel which is orthogonal to the first channel, second channel, and each of the other additional channels.

38. (currently amended) A RF coil configuration for a magnetic resonance imaging system, comprising:

at least five RF coils with bilateral symmetry, wherein the at least five RF coils are coaxial,

wherein said ~~plurality of~~ at least five RF coils is associated with a plurality of modes such that the number of modes is less than or equal to the number of RF coils, wherein said plurality of modes correspond with a plurality of current patterns, each of said plurality of current patterns having zero net mutual inductive coupling to each of the other of said plurality of current patterns in a region of interest.

39. (original) The configuration according to claim 38, further comprising:

a means for utilizing the plurality of RF coils for detecting magnetic fields associated with the plurality of current patterns.

40. (original) The configuration according to claim 38, further comprising:

a means for utilizing the plurality of RF coils for generating magnetic fields associated with the plurality of current patterns.

41. (original) A method of detecting magnetic fields in a magnetic resonance imaging system, comprising the following steps:

detecting a first magnetic field in the field of interest utilizing a pair of coils in an opposite rotation orientation associated with the first magnetic field in a region of interest, wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest, wherein the region of interest is essentially within a cylinder created by the pair of coils; and

detecting a second magnetic field in the region of interest utilizing a single coil associated with the second magnetic field in the region of interest,

wherein the single coil is positioned at an essentially zero-flux contour with respect to the first magnetic field.

Claims 42-44 were canceled.

45. (currently amended) A method of detecting magnetic fields in a magnetic resonance imaging system, comprising the following steps:

66. (original) The method according to claim 62, wherein the single coil is positioned closer to one of the coils of the pair of coils than to the other.

67. (original) The method according to claim 51, further comprising:

positioning at least one Helmholtz coil pair, wherein the at least one Helmholtz coil pair is associated with a third magnetic field essentially orthogonal to the first and second magnetic fields in the region of interest; and detecting the third magnet field with the at least one Helmholtz coil pair.

68. (original) The method according to claim 67, further comprising utilizing said at least one Helmholtz coil pair for generating the third magnetic field.

69. (original) The method according to claim 67, wherein said Helmholtz coil pair is of a configuration selected from the group consisting of: large loops, top/bottom loops, side by side loops, and a combination thereof.

70. (original) The method according to claim 51,

wherein said pairs of coils are connected together by a pair of electrical conductors to form an Alderman-Grant coil pair.

71. (original) The method according to claim 51, further comprising:

providing a switching means for allowing the pair of coils and the single coil to operate in and switch between two or more of the modes in the group consisting of:

(i) the coils of the pair of coils and the single coil having currents rotating in the same direction;

(ii) the coils of the pair of coils having currents rotating in the same direction, with the single coil operating independently;

(iii) the coils of the pair of coils having currents rotating in opposite directions, with the single coil operating independently; and

(iv) the coils of the pair of coils having currents rotating in the same direction and the single coil having a current rotating in an opposite direction with respect to the currents of the pair of coils.

72. (original) The method according to claim 51, further comprising:

positioning at least one additional pair of coils, wherein said pair of coils in an opposite orientation has odd symmetry with respect to a plane, wherein each of said at least one additional pair of coils is associated with a corresponding at least one additional magnetic field; and detecting the corresponding at least one additional magnetic field with the corresponding at least one additional pair of coils,

wherein each of said at least one additional pair of coils has even symmetry with respect to the plane and is associated with one of said at least one additional magnetic field such that said single coil is a first channel, said pair of coils in an opposite orientation is a second channel, and each of said at least one additional pair of coils is an additional channel which is orthogonal to the first channel, second channel, and each of the other additional channels.

73. (original) The method according to claim 72, wherein each of said pair of coils, said single coil, and each of said at least additional pairs of coils lie in planes parallel to each other.

74. (original) The method according to claim 73, wherein each of said pair of coils, said single coil, and each of said at least additional pairs of coils are coaxial.

75. (original) The method according to claim 57, further comprising:

positioning at least one additional pair of coils, wherein said pair of coils in an opposite orientation has odd symmetry with respect to a plane, wherein each of said at least one additional pair of coils is associated with a corresponding at least one additional magnetic field; and detecting the corresponding at least one additional magnetic field with the corresponding at least one additional pair of coils,

wherein each of said at least one additional pair of coils has odd symmetry with respect to the plane and is associated with one of said at least one additional magnetic field such that said single coil is a first channel, said pair of coils in an opposite orientation is a second channel, and each of said at least one additional pair of coils is an additional channel which is orthogonal to the first channel, second channel, and each of the other additional channels.

same magnitude current in opposite directions. The currents flowing in conductors **30** and **31** are split when the currents enter a coil, with one-half the magnitude of the current flowing in each half of the coil. For example, current flowing from conductor **30** flows one-half in each half of coil **18B** to conductor **31**, and current flowing from conductor **31** flows one-half in each half of coil **16B** to conductor **30**. In this embodiment, coils **17B** and the Alderman-Grant coil are isolated due to their perpendicular fields and coils **14B** and **15B** are isolated from one another by, for example, having their axes perpendicular to each other. Coil **17B** shares inductance and sample resistance with coils **14B** and **15B**, and the Alderman-Grant coil shares inductance and resistance with coil **14B** and **15B**.

With respect to the embodiment shown in Figure 9A, shared resistance between coils **17B** and **14B** and between coils **17B** and **15B** can limit the isolation. Preamplifier decoupling can increase the isolation to acceptable values. Also, due to the shared resistance, the amount of noise correlation in these channels is a consideration which should be taken into account.

Figures 10 and 11 illustrate switching networks which can be utilized with respect to the three solenoid embodiment, for implementing a method to allow the opposite rotation of the loop currents in either a series or parallel fashion. Figure 10 shows a switching network for allowing the outer two coils to have currents which either rotate in the same direction or in opposite directions. Referring to Figure 10, **1A'**, **2A'**, and **3A'** connect to the top contacts of loops **1B**, **2B**, and **3B** of Figure 1, while **1A**, **2A**, and **3A** connect to the bottom contacts. By closing switches **50** and **53**, loops **1B** and **3B** can be driven in the same rotation direction. By closing switches **51** and **52** and opening switches **50** and **53**, loops **1B** and **3B** can be driven in opposite rotation direction.

Figure 11 illustrates a more generalized switching network which can allow all three coils to have currents rotating in the same direction, or allow the center coil to operate independently, while the two outer coil currents either rotate in the same direction or rotate in opposite directions. Referring to Figure 11, **1A'**, **2A'**, and **3A'** connect to the top contacts of loops **1B**, **2B**, and **3B** of Figure 1, while **1A**, **2A**, and **3A** connect to the bottom contacts. The network is driven at lead pairs **54** and **55**. If switches **50** and **53** are closed, loops **1B** and